

## Synopsis of the species of *Trachurus* (Pisces, Carangidae)

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TRACHURUS is one of three closely related genera (with *Decapterus* and *Selar*) of the carangid subfamily Caranginae. The genus includes 13 species, one of which is described herein as new. It occurs in most of the neritic and inner oceanic areas of all tropical and temperate marine waters. Several species are of commercial importance.

The genus and its species are diagnosed, and an analysis of morphological variation in certain characters is given for the single western Atlantic representative, *Trachurus lathami*. The distribution of the species is shown in Fig. 1.

### METHODS AND MATERIALS

Methods and terminology follow Berry (1968, 1969). Major characters used in distinguishing the 13 species are the position of termination of the dorsal accessory lateral line beneath the dorsal fin, numbers of gillrakers on the lateral side of the first gill arch, numbers of scales and scutes in the lateral line, and relative heights of scales in the curved lateral line and scutes in the straight lateral

TABLE 1  
Frequency distributions of numbers of dorsal softrays in *Trachurus*

Species	28	29	30	31	32	33	34	35	36	37	Mean
<i>lathami</i>	5	9	33	45	23	6	1				30.8
<i>mediterraneus</i>		5	4	8	4	2	-	1			30.9
<i>picturatus</i>			1	1	4	6	5	2			33.0
<i>trecae</i>		5	4	1	2	1					30.2
<i>trachurus</i>		3	9	5	2	5					30.9
<i>capensis</i>			1	1	1	2	-	-	-	1	32.7
<i>margaretae</i>		2	2								29.5
<i>indicus</i>		1	-	4	3	1					31.4
<i>mccullechi</i>		1	3	5	7	1					31.2
<i>declivis</i>				1	1	1	-	1			32.7
<i>japonicus</i>	1	-	3	6	2						30.7
<i>symmetricus</i>				6	8	4	3	4			32.6
<i>murphyi</i>			1	1	2	2	2	5	1		33.6

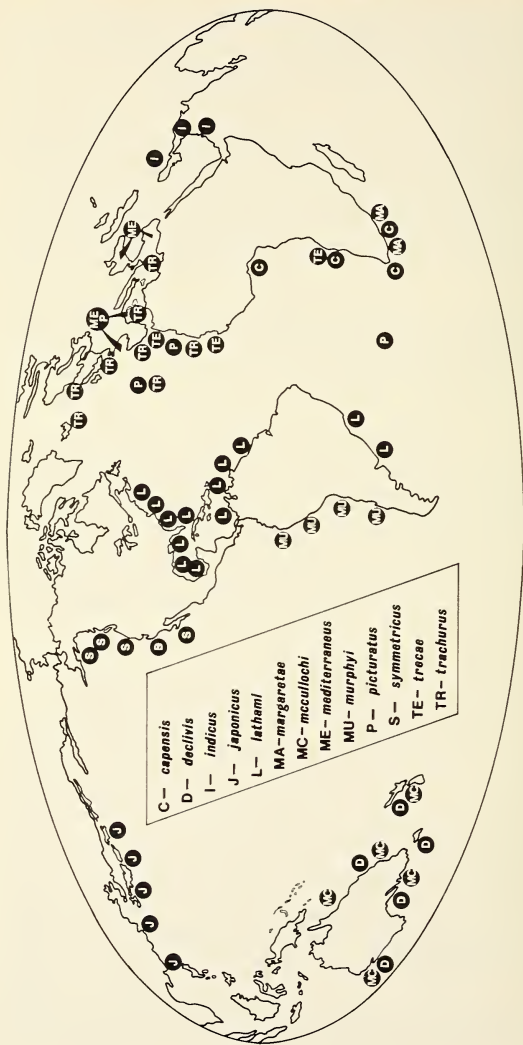


Fig. 1. Geographic distribution of the species of *Trachurus*.

line. Other useful distinguishing characters are pectoral fin length, eye diameter, and body depth.

Frequency distributions of numbers of dorsal and anal softrays are given in Tables 1-2, of gillrakers in Tables 3-5, and of lateral-line scales and scutes in Tables 6-8. Relative sizes of lateral-line scales and scutes are given in Table 9. The species can be identified by the following dichotomous key.

A list of specimens of *Trachurus* examined is given at the end of

TABLE 2  
Frequency distributions of numbers of anal softrays in *Trachurus*

Species	24	25	26	27	28	29	30	31	Mean
<i>lathamii</i>	2	4	9	38	41	22	5		27.6
<i>mediterraneus</i>			5	7	6	1			27.2
<i>picturatus</i>				3	4	7	4		28.7
<i>trecae</i>		2	3	4	1	1			26.6
<i>trachurus</i>	1	1	5	9	4	4			27.1
<i>capensis</i>				1	2	1	2		28.7
<i>margaretae</i>		2	2						25.5
<i>indicus</i>	1	-	-	3	4	1			27.3
<i>mccullochi</i>		1	1	1	8	7	1		28.2
<i>declivis</i>					2	-	2		29.0
<i>japonicus</i>				3	6	4			28.1
<i>symmetricus</i>			2	5	8	7	2		28.1
<i>murphyi</i>				2	3	5	3	1	28.9

TABLE 3  
Frequency distributions of numbers of upper limb gillrakers in *Trachurus*

Species	12	13	14	15	16	17	18	19	20	Mean
<i>lathamii</i>	2	37	49	23	4					13.9
<i>mediterraneus</i>		3	8	4	2	2				14.6
<i>picturatus</i>			1	6	4	2				15.5
<i>trecae</i>			1	2	10					15.7
<i>trachurus</i>				5	9	6	2			16.2
<i>capensis</i>					1	-	1	1	3	18.8
<i>margaretae</i>		1	2	2	1					14.5
<i>indicus</i>					6	2	1			16.4
<i>mccullochi</i>				8	7	3	1			15.8
<i>declivis</i>			1	1	2					15.3
<i>japonicus</i>			2	8	3					14.1
<i>symmetricus</i>			1	10	8	2	2			15.7
<i>murphyi</i>				1	6	5	1			16.5

TABLE 4  
Frequency distributions of numbers of lower limb gillrakers in *Trachurus*

Species	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	Mean
<i>lathamii</i>	1	5	27	37	2	1	7	2	1								36.4
<i>mediterraneus</i>						20	6	3	4								38.8
<i>picturatus</i>						7	1	5	7	3	2	1					41.8
<i>trecae</i>									2	-	3	-	2				41.5
<i>trachurus</i>									2	2	1	4	3	7	3	1	44.8
<i>capensis</i>																	51.5
<i>margaretae</i>							2	-	1	2	1		(A: range 49-56)				41.0
<i>indicus</i>									7	4	2	2	-	-	1		43.4
<i>macullochi</i>					1	1	-	1	7	5	4						41.3
<i>declivis</i>						1	2	1									39.0
<i>japonicus</i>						4	5	2	1	1							39.2
<i>symmetricus</i>						2	3	7	8	1	2						40.4
<i>murphyi</i>										2	2	3	5				43.9

A: 49(1), 50(3), 54(1), 56(1).



TABLE 5  
 Frequency distributions of sum of numbers of upper and lower  
 limb gillrakers of *Trachurus*

Species	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	Mean		
<i>lathamii</i>	3					3	-	4	2	4	6											50.2	
<i>mediterraneus</i>										5	-	1	2	1									54.0
<i>picturatus</i>										3	3	-	2	3	1								57.2
<i>trecae</i>								1	2	4	1	1	-	3	-								57.2
<i>trachurus</i>										1	2	2	-	2	3	5	4	2	2	2			61.1
<i>capensis</i>																							70.3
<i>margaretae</i>							1	1	-	-	1	2	1										55.5
<i>indicus</i>													3	3	1	1	-	-	-	1			59.6
<i>mecullochi</i>								1	1	1	2	6	5	2	-	1							57.1
<i>declivis</i>								1	1	2													54.3
<i>japonicus</i>						1	2	4	4	1	1												53.6
<i>symmetricus</i>								2	8	4	4	7	-	2									56.0
<i>murphyi</i>													1	2	3	4	1	1					60.4

A: 66(1), 68(1), 69(2), 74(1), 76(1).

TABLE 6  
Frequency distributions of the numbers of scales and scutes  
in the curved lateral line of *Trachurus*

Species	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	Mean
<i>lathamii</i>	1	-								7	2	2							37.2
<i>mediterraneus</i>									2	2	2	-	3	3	6	5	-	1	43.7
<i>picturatus</i>										(A: range 52-58)									55.6
<i>trecae</i>						1	1	2	5	2	-	1	1						39.2
<i>trachurus</i>	1	-	6	5	2	6	1	3											36.8
<i>capensis</i>	1	1	1	1	1	1	-	-	1	-	-	-	-	-	1				37.8
<i>margaretae</i>	1	1	1	3															35.0
<i>indicus</i>					4	3	1	-	1										38.0
<i>maculochi</i>			1	2	7	5	2	1											36.4
<i>declivis</i>									1	-	1	2							42.0
<i>japonicus</i>					2	5	3	3											37.5
<i>symmetricus</i>										(B: range 46-56)									52.4
<i>murphyi</i>										(C: range 51-56)									53.0

A: 52(1), 54(5), 55(2), 56(3), 57(6), 58(1).

B: 46(1), 48(1), 49(1), 50(1), 51(2), 52(4), 53(3), 54(1), 55(4), 56(2).

C: 51(1), 52(7), 53(1), 55(1), 56(2).



this paper. The institutions in which they are preserved are given in the section on acknowledgments.

*Trachurus* Rafinesque, 1810

*Trachurus* Rafinesque, 1810, p. 41 (type species ? *Trachurus suareus* Risso in Cuvier and Valenciennes, 1833=*Trachurus picturatus* Bowdich, 1825).

*Brachialepes* Fowler, 1938, p. 46 (type species *Selar tabulae* Barnard, 1927 = *Trachurus capensis* (Castelnau, 1861)).

*Suareus* Dardignac and Vincent in Furnestin et al., 1958, p. 444 (type species *Suareus furnestini* Dardignac and Vincent, 1958 = ? *Trachurus mediterraneus* Steindachner, 1868).

*Diagnosis.* A genus of Caranginae with teeth in a single row in both jaws, a narrow longitudinal band of teeth on tongue and narrow band on each palatine, and vomer with a narrow anchor-shaped arrangement of teeth. Scales in anterior (curved) part of lateral line enlarged and almost scutelike. Dorsal accessory lateral line extending posteriad to below middle of first dorsal fin or beyond. First two anal spines subequal or the first one usually the longer. Low scaled sheath along bases of dorsal and anal soft-rays; scales on head extending anteriorly above eyes, largely covering all opercular bones, suborbital area, and on expanded portion of maxillae; scales on membranes between anterior three or four rays of second dorsal and second anal fins, and scales on membranes between most rays of pectoral, pelvic, and caudal fins. A slight furrow on dorsal edge of cleithral ridge, but no papillae. Anterior lobes of soft dorsal and anal fins relatively low. Last soft-ray of dorsal and anal fins becoming displaced from rest of fin with growth in some species, but not forming a detached finlet. First dorsal fin with eight spines. Second dorsal fin with one spine and 28-37 soft-rays. Anal fin with two spines followed by one spine and 24-31 soft-rays. Gillrakers on upper limb 12-20, on lower limb 33-56. Lateral line scales and scutes 66-107. Branchiostegal rays, seven. Vertebrae 10+14.

*Synonymy.* The type species of *Trachurus* is uncertain, although most authors have cited it as *T. saurus* Rafinesque (= *T. trachurus* Linnaeus) (see Jordan, 1917, p. 79). The genus was established by Rafinesque (1810, p. 41), who included the three species *Trachurus Aliciolus*, *Trachurus Imperialis* (with *Trachurus Saurus* listed under that account), and *Trachurus Aguilus*, described on page 42 as new.

Based on his account and his plate 11, only *T. imperialis* appears to belong to the Caranginae, and it has generally been regarded as a junior synonym of *Caranx dentex* (Bloch and Schneider 1801). Later, Rafinesque (1815, pp. 20-21) listed five species under *Trachurus*. The first was "*Trachurus saurus* Raf. (*Caraux trachurus* Lac. *Scomber trachurus* Linn.)." *T. saurus* Rafinesque 1810 in a *nomen nudum*. If *T. saurus* Rafinesque 1815 were regarded as a replacement name for *T. trachurus* (Linnaeus 1758), this would invalidate the tautonym and first named species of the genus (as we now know it). *T. suareus* Risso 1833, was documented by Cuvier in Cuvier and Valenciennes (1833, p. 33) and examination of the holotype (by Berry) discloses that it is a junior synonym of *T. picturatus* (Bowdich, 1825).

Several genera of Carangidae, including the type genus *Caranx* and *Trachurus*, may be regarded as technically invalid, but they have entrenched usage and should be conserved. When the generic limits and the nominal species are all finally analyzed, an appeal for this conservation should be made.

#### Key to the Species of *Trachurus*

1. Dorsal accessory lateral line extending posteriad to beyond 5th dorsal  
softray ..... 2  
Dorsal accessory lateral line terminating anterior to 5th dorsal softray ..... 5
2. Dorsal accessory lateral line terminating below 19th-32nd dorsal  
softray ..... 3  
Dorsal accessory lateral line terminating below 6th to 10th dorsal  
softray ..... 4
3. Lower limb gillrakers 41-48 (Northeastern Atlantic) ..... *trachurus*  
Lower limb gillrakers 49-56 (Southeastern Atlantic) ..... *capensis*
4. Scales and scutes in curved lateral line 40-43 (Australia, New  
Zealand) ..... *declivis*  
Scales and scutes in curved lateral line 52-58 (Eastern Atlantic) *picturatus*
5. Dorsal accessory lateral line terminating below first 3 to 6 spines of  
dorsal fin (Eastern Atlantic) ..... *trecae*  
Dorsal accessory lateral line terminating below 7th dorsal spine to 4th  
dorsal softray ..... 6
6. Total scales and scutes in lateral line 68-89 ..... 8  
Total scales and scutes in lateral line 93-107 ..... 7
7. Scales in curved lateral line low, 2.3-3.1 per cent SL (Northeastern  
Pacific) ..... *symmetricus*  
Scales in curved lateral line high, 4.6-5.6 percent SL (Southeastern  
Pacific) ..... *murphyi*

8. Scutes in straight lateral line high, 6.8-7.5 per cent SL *and* scales in curved part less high than scutes in straight part, 1.30-1.48 ratio (South Africa) ..... *margaretae*  
 Scutes in straight lateral line low, 4.5-6.8 per cent SL, *or* scales in curved part higher than scutes in straight part..... 9
9. Pectoral fin short, less than 27 per cent SL at sizes of 100 mm SL and larger (Eastern Atlantic)..... *mediterraneus*  
 Pectoral fin more than 27 per cent SL ..... 10
10. Eye small at sizes greater than 165 mm SL, diameter 7.4 per cent SL or less (Australia, New Zealand) ..... *mccullochi*  
 Eye 7.8 per cent SL or larger ..... 11
11. Lower gillrakers 42-47; *and* scutes in straight lateral line not high, 4.8-5.4 per cent SL (Arabian Sea, Persian Gulf)..... *indicus*  
 Lower gillrakers 33-40; *or* scutes in straight lateral line higher, 6.1-7.4 per cent SL ..... 12
12. Height of scales in curved part and scutes in straight part of lateral line greater, 5.5-7.0 per cent SL curved and 6.1-7.4 per cent SL straight (Japan and China) ..... *japonicus*  
 Height of scales in curved part and scutes in straight part of lateral line less, 4.2-6.2 percent SL curved, 5.0-6.8 per cent SL straight (Western Atlantic) ..... *lathami*

*Trachurus mediterraneus* (Steindachner)

- Caranx trachurus mediterraneus* Steindachner, 1868, p. 393 (type locality Mediterranean Sea).
- Trachurus mediterraneus ponticus* Aleev, 1956, p. 178 (type locality Black Sea).
- ?*Suareus furnestini* Dardignac and Vincent in Furnestin et al, 1958, p. 445 (type locality Morocco).

*Diagnosis.* Dorsal accessory lateral line extending posteriad beneath dorsal fin to between eighth spine and third soft-ray. Scales and scutes in curved part of lateral line 39-48. Total scales and scutes in lateral line 75-89. Height of scales or scutes in curved lateral line, 3.3-4.3 per cent SL; in straight lateral line 4.5-5.3 per cent SL. Ratio of height of straight to curved lateral-line scales 1.15-1.47. Total gillrakers, 50-59. Pectoral length 24.5-26.5 per cent SL above 125 mm SL. Body depth 22.0-24.2 per cent SL. Eye diameter 8.2-8.8 per cent SL.

*Remarks.* Conflicting opinions exist about the species and subspecies of *Trachurus* and their proper scientific names in the north-eastern Atlantic-Mediterranean-Black Sea area (see for example Tortonese 1952, Aleev 1956, Blanc and Bauchot 1961, and Slasten-

enko 1965). We accept the opinion of Aleev (1956, p. 183) that *Scomber lacerta* Pallas 1811 is a *nomen dubium*. Based on the limited amount of material available in this study and our attempt to ameliorate various pronouncements in the literature, we tentatively recognize three species in the above area: *trachurus*, *picturatus*, and *mediterraneus*.

*Relationships.* *T. mediterraneus* is most similar morphologically to *lathami* (discussed under that species) and to *indicus*. Compared to *mediterraneus*, *indicus* has a longer pectoral fin (27.2-32.5 per cent SL vs. 24.5-26.7 per cent SL) and a greater body depth (26.1-28.2 per cent SL vs. 22.0-24.2 per cent SL), but the differences in gross appearance of the two species suggest that they are not closely related phylogenetically.

*Distribution.* Northeastern Atlantic from the Bay of Biscay to the Straights of Gibraltar and the Mediterranean, Black, Marmana, and Azov Seas (Aleev, 1956); to Casablanca (if *furnestini* is a valid synonym).

### *Trachurus picturatus* Bowdich

*Seriola picturata* Bowdich, 1825, p. 123, fig. 27 (type locality Madeira).

*Caranx suareus* Risso in Cuvier and Valenciennes, 1833, p. 33 (type locality Mediterranean; holotype 435 mm SL, MNHN B.869).

*Trachurus melanosaurus* Cocco, 1839, p. 1.

*Caranx cuvieri* Lowe, 1841, p. 183 (type locality Madeira).

*Trachurus fallax* Capello, 1868, p. 318 (type locality Portugal).

*Trachurus rissoi* Giglioli, 1880, p. 27.

*Decapterus longimanus* Norman, 1935, p. 255, fig. 1 (type locality Tristan de Cunha; holotype 412 mm SL, BMNH 1935.5.2.3).

*Diagnosis.* Dorsal accessory lateral line extending posteriad beneath dorsal fin to between 6th and 10th softrays. Scales and scutes in curved part of lateral line 52-58. Total scales and scutes in lateral line 93-100. Height of scales or scutes in curved lateral line, 3.6-5.1 per cent SL; in straight lateral line 3.9-5.4 per cent SL. Ratio of height of straight to curved lateral-line scales 1.03-1.21. Total gill-rakers 55-60. Pectoral length 23.4-29.3 per cent SL. Body depth 18.8-22.2 per cent SL. Eye diameter 7.1-9.7 per cent SL.

*Remarks.* We have not investigated the synonymy of this species, but follow the account of Tortonese (1950), with the addition of two synonyms. A direct comparison of an adequate series



of specimens might reveal differences between those from the North Atlantic and those from the South Atlantic.

Arrangement of dentition is similar in all species of the genus, but variation was noted in three of nine specimens of *T. picturatus* from Maderia; two had an enlarged head of the vomer (MMF 3432 and 3859), and one had an expanded vomerine shaft (MMF 21674).

*Relationships.* The very extended dorsal accessory lateral line and the high number of scales and scutes in the lateral line differentiate *picturatus* from all other *Trachurus*. *T. picturatus* appears most closely related morphologically to *murphyi* and *declivis*. Suspected hybridization is discussed under the account of *T. trachurus*.

*Distribution.* Northeast Atlantic in the Bay of Biscay, from the Azores to the Canary Islands, and in the Mediterranean Sea (Aleev, 1956); southeastern Atlantic at Tristan de Cunha.

#### *Trachurus trecae* Cadenat

*Trachurus trecae* Cadenat, 1949, p. 668 (type locality Mauritania; two syntypes, MNHN 50-71, 158-178 mm SL).

*Diagnosis.* Dorsal accessory lateral line normally extending posteriad beneath dorsal fin to between the first and sixth spines. Scales and scutes in curved part of lateral line 36-43. Total scales and scutes in lateral line 71-78. Height of scales or scutes in curved lateral line, 2.1-2.9 per cent SL; in straight lateral line, 3.2-4.0 per cent SL. Ratio of height of straight to curved lateral-line scales 1.39-1.61. Total gillrakers 54-61. Pectoral length 28.3-30.3 per cent SL at sizes larger than 125 mm SL. Body depth 25.0-27.1 per cent SL. Eye diameter 8.4-9.4 per cent SL.

*Remarks.* The dorsal accessory lateral line is shorter and ends farther forward in *trecae* than in other *Trachurus*. On the basis of our definition of the termination point (from beneath the anterior origin of a dorsal fin spine to the origin of the succeeding spine posteriad), 656 specimens of *trecae* from throughout most of its range had the following frequency distribution of accessory lateral-line terminations:

spine position	0	1	2	3	4	5	6
number of specimens	3	8	36	192	379	35	3.

In the three specimens (from three separate collections) with the zero position, the accessory lateral line ended well anterior to the



dorsal fin. Tabulations were taken on the left side of each fish. The termination on the right was usually symmetrical, but varied slightly in some specimens; two specimens from one collection lacked the line on the right side.

*Distribution.* Mauritania to Angola.

### *Trachurus trachurus* (Linnaeus)

*Scomber trachurus* Linnaeus, 1758, p. 298 (type locality Mediterranean).

*Caranx semispinosus* Nilsson, 1832, p. 84 (type locality Norwegian Sea).

*Trachurus europaeus* Gronovius, 1854, p. 125 (type locality seas of Europe: holotype BMNH 1853.11.12.95, length 189 mm).

*Trachurus linnaei* Malm, 1877, p. 421 (type locality Bohuslän, Sweden).

*Diagnosis.* Dorsal accessory lateral line extending posteriad beneath dorsal fin to between 23rd and 31st soft-rays. Scales and scutes in curved lateral line 33-40. Total scales and scutes in lateral line 66-75. Height of scales or scutes in curved part of lateral line, 6.3-8.2 per cent SL; in straight lateral line, 6.5-7.9 per cent SL. Ratio of height of straight to curved lateral line scale 1.05-1.23. Total gillrakers 56-65. Pectoral length 26.6-28.2 per cent SL at sizes larger than 150 mm SL. Body depth 21.6-24.1 per cent SL. Eye diameter 8.2-8.9 per cent SL.

*Remarks.* Three of 23 specimens of *Trachurus* examined from Madeira were intermediate in appearance and in certain characters between the two species, *trachurus* and *picturatus*, known to occur there. They may represent a distinct species, but we consider them hybrids, especially because we have so few specimens from a single oceanic location. The following text-table indicates the intermediacy of the specimens we presume to be hybrids on the basis of ranges of four characters; number of scales and scutes in curved lateral line (A), number of scutes in straight lateral line (B), numbered soft-ray under which the accessory lateral line ends (C), and relative height of scales in the curved lateral line as percent SL (D):

	A	B	C	D
<i>picturatus</i>	52-58	39-46	6-8	3.6-5.1
hybrids	44-46	35-38	15-23	5.8-6.5
<i>trachurus</i>	35-40	31-36	23-32	6.3-8.2

One hybrid (TABL 106537) has nine spines in the first dorsal fin and eight associated interneurals. Eight first dorsal spines and seven associated interneurals is the maximum number normally found in most species of Caranginae. In examining thousands of specimens of most species of the subfamily we found only one other specimen with nine first dorsal spines, *Uraspis secunda* (Poey), MCZ 16073.

One specimen from Madeira (256 mm SL, MMF 3409), with a pug-nosed condition, had an extremely distorted and expanded shaft of the vomer.

Because of our relatively small sample of specimens of *trachurus*, we have not been able to analyze the possibility of subspecies in this species. A clinal relationship in three meristic characters was evident. A comparison of six specimens from Scandinavia, 11 from the Mediterranean, and seven from Madeira, revealed mean increases from 32.5-33.7-34.9, respectively, in scutes in the straight lateral line, increases from 57.6-61.4-63.1 in total gillrakers, and increases from 56.0-57.8-59.5 in sums of dorsal and anal soft-rays. A similar trend was seen in specimens of the closely related *capensis* from Nigeria and South Africa in means of total gillrakers but not in other characters.

*Relationships.* The eastern Atlantic *trachurus* and *capensis* are the only species of the genus with the accessory lateral line extending so far posteriorly on the body (to beneath the 19th dorsal soft-ray or beyond). *T. trachurus* has fewer total gillrakers (56-65 vs. 66-76) and higher scales and scutes in the lateral line (6.3-8.2 per cent SL vs. 4.8-5.2 per cent SL in the curved lateral line: 6.5-7.9 per cent SL vs. 5.5-5.9 per cent SL in the straight lateral line).

*Distribution.* Northeast Atlantic from Iceland to the Cape Verde Islands and Mediterranean Sea eastward to the Bosphorus (Aleev, 1956).

### *Trachurus capensis* Castelnau

*Trachurus capensis* Castelnau, 1861, p. 43 (type locality South Africa).

*Selar tabulae* Barnard, 1927, p. 538 (type locality Table Bay, South Africa; holotype in South African Museum, length 410 mm).

*Diagnosis.* Dorsal accessory lateral line extending posteriorly beneath dorsal fin to between 19th and 27th soft-rays. Scales and scutes

in curved lateral line 34-45. Total scales and scutes in lateral line 71-79. Height of scales or scutes in curved part of lateral line, 4.8-5.2 per cent SL; in straight lateral line, 5.5-5.9 per cent SL. Ratio of height of straight to curved lateral line scales 1.05-1.23. Total gillrakers 66-76. Pectoral length 27.7-29.7 per cent SL, above 175 mm SL. Body depth 23.2-27.5 per cent SL. Eye diameter 7.9-8.5 per cent SL.

*Remarks.* Castelnau's name of *capensis* is accepted for this species following the opinion of Nichols (1920, 1935). Margaret M. Smith (personal communication) informed us that the type of Barnard's *tabulae* had been examined by J. L. B. Smith, who found that it was a *Trachurus*. The high counts of dorsal soft-rays (38), and lower limb gillrakers (55) given for *tabulae* by Barnard (1927, p. 538) cause us to synonymize these two nominal species.

*Relationships.* The relation to *trachurus* and differentiation of *capensis* and *trachurus* are discussed under that species.

*Distribution.* Imperfectly known. Specimens examined by us from Nigeria and South Africa. Reported westward to Delagoa Bay by Smith (1961, p. 213). Apparently reported from Angola (as *T. trachurus*) by Poll (1954, p. 117).

#### *Trachurus margaretae*, new species (Fig. 2)

*Diagnosis.* Dorsal accessory lateral line extending posteriorly beneath dorsal fin to between eighth and ninth spines. Scales and scutes in curved part of lateral line 33-36. Total scales and scutes in lateral line 69-73. Height of scales or scutes in curved lateral line, 4.7-6.0 per cent SL; in straight lateral line, 6.5-7.5 per cent SL. Ratio of height of straight to curved lateral line scales 1.09-1.48. Total gillrakers 52-58. Pectoral length 30.9-32.0 per cent SL at 157-154 mm SL, 25.9 per cent SL from 89.5-123 mm SL. Body depth 23.2-26.1 per cent SL. Eye diameter 8.5-9.1 per cent SL.

*Material.* Holotype, USNM 93661, 123 mm SL, from Durban, South Africa. Paratypes: USNM 153510, 3 specimens, 68.5-89.5 mm SL, from Knysna Estuary, South Africa; SAM 16734, 174 mm SL, South Africa; TABL 107267, 157 mm SL, Durban, South Africa.

*Description of the holotype.* Standard length 123 mm. Caudal fin broken. Accessory lateral line ending under ninth dorsal spine. Dorsal fin VIII, I-29. Anal fin II, I-25. Pectoral fins I-20 (both). Pelvic fins I-5 (both). Gillrakers 16+41 (right side), 15 over



Fig. 2. *Trachurus margaretae* n. sp., holotype, Durban, South Africa, 123 mm SL (USNM 93661).

hypobranchial including one anterior rudiment. Gill filaments on lateral side of first arch 33+81 (right). Pseudobranch filaments 21 (left). Branchiostegal rays 3+4 (both). Lateral line, curved (right) 30 scales and 4 scutes; curved (left), 31 scales and 3 scutes; straight (right), 38 scutes and 3 scales; straight (left), 39 scutes and 3 scales. Vertebrae 10+14. Measurements in per cent SL: head length 28.6; eye diameter 8.5; snout length 8.0; postorbital head length 11.5; upper jaw length 10.7; maxillary depth 3.7; body depth, 24.2 maximum vertical, 25.0 from first dorsal spine to pelvic insertion, 25.0 from ninth dorsal spine to first anal spine; pectoral

length 25.9; pelvic length 16.2; longest dorsal spine 15.5 (3rd); longest dorsal soft-ray ca. 14.0 (1st); anal spine lengths, 6.4 (1st), 5.8 (2nd); longest anal soft-ray ca. 13.1 (1st); maximum height of scales or scutes in curved lateral line 5.8, in straight lateral line, 7.5. Ratio of height of straight to curved lateral line scales 1.29. Ratio of lengths of curved to straight lateral line 0.70 (both).

*Remarks.* Two species occur in South African waters and two available names exist for *Trachurus* from that area. The later named species (*tabulae* of Barnard) is not this new species, especially in view of the high lower limb gillraker count (55) given in the original description. The first named species (*capensis* of Castelnau) has such an imprecise description (and we do not know if a type specimen exists) that we relate it to the more common species from South Africa, as has been done previously. We therefore describe the rarer *T. margaretae* as new.

*Distribution.* Currently known only from Durban and Knysna Estuary, South Africa.

*Name.* Named in honor of Margaret Mary Smith, Director, J. L. B. Smith Institute of Ichthyology.

### *Trachurus indicus* Necrassov

*Trachurus mediterraneus indicus* Necrassov, 1966, p. 141 (type locality off Oman, Arabian Sea).

*Diagnosis.* Dorsal accessory lateral line extending posteriad beneath dorsal fin to between seventh and eighth spines. Scales and scutes in curved part of lateral line 37-41. Total scales and scutes in lateral line 72-79. Height of scales or scutes in lateral line, 3.6-5.1 per cent SL curved, 4.8-5.4 per cent SL straight. Ratio of height of straight to curved lateral line scales 1.06-1.34. Total gillrakers 58-65. Pectoral length 29.9-32.5 per cent SL, at sizes larger than 168 mm SL. Body depth 26.1-28.2 per cent SL. Eye diameter 8.5-10.1 per cent SL.

*Remarks.* In one specimen (TABL 105998) the accessory lateral line is abnormally bent near its termination on each side of the body; it ends abnormally short under the first spine on the right side and under the fourth spine on the left.

*Relationships.* Discussed under the account of *mediterraneus*.

*Distribution.* Gulf of Oman and Persian Gulf.

*Trachurus mccullochi* Nichols

*Trachurus mccullochi* Nichols, 1920, p. 479 (type locality Australian seas; description based on account of McCulloch, 1915).

*Diagnosis.* Dorsal accessory lateral line extending posteriad beneath dorsal fin to between eighth spine and second dorsal soft-ray. Scales and scutes in curved part of lateral line 34-39. Total scales and scutes in lateral line 71-77. Height of scales or scutes in curved lateral line, 4.8-6.9 per cent SL; in straight lateral line, 5.0-7.3 per cent SL. Ratio of height of straight to curved lateral line scales 0.98-1.18. Total gillrakers 53-61. Pectoral length 27.2-29.7 per cent SL at sizes larger than 110 mm SL. Body depth 21.3-26.3 per cent SL. Eye diameter 8.0-9.7 per cent SL on specimens 78-160 mm SL, 6.4-7.2 on three specimens 166-252 mm SL.

*Remarks.* Our material is in relatively poor condition and insufficient for a thorough definition of this species. The three largest specimens are certainly distinctive. The 16 smaller specimens (which have relatively larger eyes) are assigned to this species, but they are morphologically more similar to *japonicus* of the northwest Pacific.

*Relationships.* *T. mccullochi* may be a southern hemisphere cognate of *japonicus*, but it has a larger eye than that species at sizes larger than about 220 mm SL. It is differentiated from *lathamii* under the account of that species.

*Distribution.* Australia and New Zealand.

*Trachurus declivis* (Jenyns)

*Caranx declivis* Jenyns 1841, p. 68 (type locality King George's Sound, New Holland, holotype BMNH 1917.7.14.30, 163 mm SL).

*Trachurus novae zealandiae* Richardson, 1842, p. 21 (type locality New Zealand; description based on the vernacular "Le saurel de la Nouvelle-Zélande" by Cuvier in Cuvier and Valenciennes, 1833, p. 26).

*Diagnosis.* Dorsal accessory lateral line extending posteriad beneath dorsal fin to between sixth to tenth soft-rays. Scales and scutes in curved lateral line 40-43. Total scales and scutes in lateral line 81-82. Height of scales or scutes in curved part of lateral line, 7.5-8.0 per cent SL; in straight lateral line, 6.8-7.4 per cent SL. Ratio of height of straight to curved lateral-line scales 0.85-1.00. Total



gillrakers 53-55. Pectoral length ca. 25.0-28.0 per cent SL. Body depth 22.0-23.1 per cent SL. Eye diameter ca. 7.0-8.3 per cent SL.

*Remarks.* Examination of the holotype (by Berry) confirms the identity of this species; the dorsal accessory lateral line is difficult to discern in the somewhat damaged specimen but apparently ends under the 10th dorsal soft-ray on the left side and under the 9th on the right.

*Distribution.* Australia and New Zealand.

### *Trachurus japonicus* (Temminck and Schlegel)

*Caranx trachurus japonicus* Temminck and Schlegel, 1844, p. 109 (type locality Japan).

*Trachurus argenteus* Wakiya, 1924, p. 145 (type locality Amakusa, Japan; paratype FMNH 59421, 285 mm SL).

*Diagnosis.* Dorsal accessory lateral line extending posteriad beneath dorsal fin to between ninth spine and second soft-ray. Scales and scutes in curved part of lateral line 36-39. Total scales and scutes in lateral line 69-73. Height of scales or scutes in lateral line, 5.5-7.0 per cent SL curved, 6.1-7.4 per cent SL straight. Ratio of height of straight to curved lateral line scales 0.98-1.24. Total gillrakers 51-56. Pectoral length 28.9-30.9 per cent SL at 227 mm SL and larger. Body depth 24.6-26.6 per cent SL at 227 mm SL and larger. Eye diameter 7.8-8.3 per cent SL at 227 mm and larger.

*Relationships.* *T. japonicus* appears to be closest morphologically to the most geographically distant species, *lathamii*, but the similarity may represent parallel evolution of morphological characters in similar ecotypes. It is also similar to *mccullochi*. See under the accounts of those two species.

*Distribution.* Japan and China.

### *Trachurus symmetricus* (Ayres)

*Caranx symmetricus* Ayres, 1855, p. 62 (type locality San Francisco Bay, California).

*Decapterus polyaspis* Walford and Myers, 1944, p. 45 (type locality off Reedsport, Oregon; holotype SU 14375, 380 mm SL).

*Diagnosis.* Dorsal accessory lateral line extending posteriad beneath dorsal fin to between eighth spine and second soft-ray. Scales

and scutes in curved part of lateral line 46-56. Total scales and scutes in lateral line 93-107. Height of scales or scutes in curved lateral line, 2.3-3.1 per cent SL; in straight lateral line, 3.9-4.4 per cent SL. Ratio of height of straight to curved lateral line scales 1.29-1.73. Total gillrakers 54-59. Pectoral length 24.4-25.9 per cent SL above 145 mm SL. Body depth 19.2-21.5 per cent SL. Eye diameter 7.6-8.6 per cent SL.

*Relationships.* *T. symmetricus* and *murphyi* appear to be an antitropical species pair; they may be separated by the smaller scales and scutes in the lateral line of *symmetricus* and its fewer average number of gillrakers on the lower limb.

*Distribution.* Alaska to southern Baja California, Mexico, and the Gulf of California.

### *Trachurus murphyi* Nichols

*Trachurus murphyi* Nichols, 1920, p. 476 (type locality Central Island of the Chimchas, Peru; putative neotype AMNH 7259, 296 mm).

*Diagnosis.* Dorsal accessory lateral line extending posteriad beneath dorsal fin to between first and fifth softrays. Scales and scutes in curved part of lateral line 52-56. Total scales and scutes in lateral line 94-106. Height of scales or scutes in lateral line, 4.6-5.6 per cent SL curved, 4.8-5.7 per cent SL straight. Ratio of height of straight to curved lateral line scales 0.98-1.07. Total gillrakers 58-63. Pectoral length 30.2-32.1 per cent SL at sizes larger than 180 mm SL. Body depth 20.5-24.0 per cent SL. Eye diameter 8.0-9.1 per cent SL to about 300 mm SL, decreasing to ca. 6.3 per cent SL at sizes larger than 400 mm SL.

*Remarks.* The type specimens of *murphyi* have been confused. Nichols (1920:478) mentioned having two specimens from Peru in the American Museum of Natural History when he described the species as new, and he listed the "type" as AMNH 7259. The AMNH catalog lists the holotype under this number and presumably the second specimen as AMNH 7260. With the assistance of C. Lavett Smith, three unlabeled or mislabeled AMNH specimens were examined by Berry; they were the only three AMNH specimens that could be regarded as types of *murphyi*. One measuring 256 mm bore a paper label with the number "7260" inside the operculum, but because that specimen appeared to be *japonicus*, it



was assigned a new number. A 295-mm specimen, with the tail broken off and no label, is *murphyi* and is associated with AMNH 7260. An unlabeled 296-mm specimen with a damaged and overgrown area of scutes on the straight lateral line of the left side fits the brief description of the species by Nichols. That specimen is assigned AMNH 7259 and is herein designated as the putative neotype of *T. murphyi* (in the sense of Whitehead, Boeseman, and Wheeler, 1966, pp. 14-15).

*Relationships.* *T. murphyi* is most closely related morphologically and geographically to *T. symmetricus*, which see. *T. murphyi* is intermediate between the seven species that have the dorsal accessory lateral line ending close to the first and second dorsal fins and *declivis* of Australia and *picturatus* of the eastern Atlantic; *murphyi* appears to be an ecotype of *picturatus* in that it has a large number of scutes in the lateral line.

*Distribution.* Off northern Peru to south-central Chile.

### *Trachurus lathami* Nichols (Fig. 3)

*Trachurus lathami* Nichols, 1920, p. 479 (type locality Long Island, New York; holotype AMNH 7351, 96 mm SL).

*Trachurus picturatus binghami* Nichols, 1940, p. 2 (type locality off Mobile Bay, Alabama; holotype AMNH 15212, 73 mm SL).

*Trachurus picturatus australis*, Nani, 1950, p. 178 (type locality Quequén, Argentina; holotype SIMACN 4175, 188.5 mm TL).

*Diagnosis.* Dorsal accessory lateral line extending posteriad beneath dorsal fin to between eighth spine and fourth soft-ray. Scales and scutes in curved lateral line 31-42. Total scales and scutes in lateral line 68-77. Height of scales or scutes in curved lateral line, 4.2-6.2 per cent SL; in straight lateral line 5.0-6.8 per cent SL. Ratio of height of straight to curved lateral-line scales 1.08-1.28. Total gillrakers on lateral side of first arch 46-54. Pectoral length 26.8-32.8 per cent SL at sizes larger than 100 mm SL. Body depth 24.2-27.5 per cent SL. Eye diameter 7.8-10.0 per cent SL; 7.8-9.2 per cent SL at sizes larger than 200 mm SL.

*Remarks.* Many subjective species synonyms have been proliferated in certain groups of the Carangidae. Most of these are from specimens of wide-ranging species collected in diverse places by earlier workers. The reverse has been true of the genus *Trachurus*,

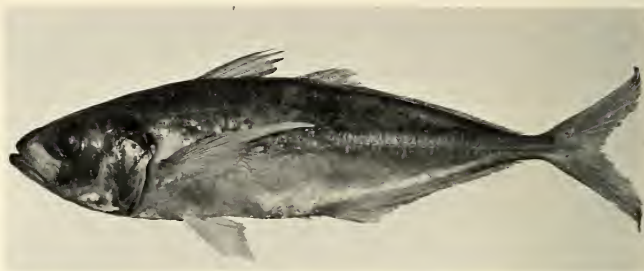


Fig. 3. *Trachurus lathami* Nichols, Trinidad, 266 mm SL, 12.3 inches total length (TABL 101836).

where the first-named species, *T. trachurus* (Linnaeus, 1758), which occurs only in the northeastern Atlantic, often has been uncritically assigned a world-wide distribution. During the last 40 years, *Trachurus* has been reported in the western Atlantic under the following names: *T. trachurus*, *T. declivis*, *T. lathami*, *T. picturatus*, *T. picturatus binghami*, *T. picturatus australis*, and two or three species have been considered to exist in the western Atlantic by several authors (as Nichols, 1940 and Nani, 1950).

No account that lists species other than *lathami* from the western Atlantic is sufficiently convincing to justify the existence of any other species than *lathami* there. We suspect that the high total lateral-line scale counts (76-87) "estimated in 8 specimens of 27 to 35 mm." from the western Atlantic by Nichols (1940) are in error. All specimens we examined from the western Atlantic represent a single species, and we presume that *lathami* is the only species of *Trachurus* that occurs in the area.

We regard the poor description of *Caranxom plumierianus* Lacépède (1802, p. 82, pl. 2), based on a drawing by Plumier from Martinique, to be a *nomen nudum*. Jordan and Evermann (1896, p. 911) suggested that it might represent a western Atlantic *Trachurus*. It might be equally well postulated that the description is a species of *Decapterus*, *Selar*, or *Caranx*.

*Relationships.* *T. lathami* is morphologically most similar to three other species. *T. mediterraneus* has a shorter pectoral fin (24.5-26.7 per cent SL vs. 26.8-32.8 per cent SL for *lathami*, each for specimens larger than 100 mm SL) and a less deep body (22.0-

24.2 per cent SL vs. 24.2-27.5 per cent SL). *T. mccullochi*, at sizes greater than 200 mm SL, has a smaller eye (ca. 6.4-7.2 per cent SL vs. 7.8-9.2 per cent SL for *lathami*), a more pointed head profile, and averages a lesser body depth. *T. japonicus* is the species most distant geographically and most similar morphologically to *lathami*; *japonicus* averages a slightly greater height of curved and straight lateral-line scales (Table 9).

*Distribution.* From the Gulf of Maine to northern Argentina. We have examined specimens from off Massachusetts, New York, North Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, Mexico (Tabasco and Campeche), Colombia, Venezuela, Trinidad, Grenadines, Surinam, French Guiana, Brazil (São Paulo), and Argentina (Rio de la Plata).

#### VARIATION IN *Trachurus lathami*

*Dorsal and anal fin spines.* The dorsal fin had 8+1 spines and the anal 2+1 spines in all 115 specimens counted. The third dorsal spine is the longest, measuring about 12.8-14.9 per cent SL. The first anal spine is normally longer than the second and measures about 4.2-5.8 per cent SL at smaller sizes, decreasing to about 3.5-4.2 per cent SL at sizes larger than 200 mm SL.

*Dorsal and anal softrays.* The numbers of dorsal and anal soft-rays are positively correlated, with a mode at D31-A28 (Table 10). The number of dorsal softrays is usually three more than the number of anal softrays, and ranges from one to seven more. The individual frequency distributions are shown in Tables 1-2. The first softray of the dorsal and anal fins is usually the longest in each fin. The first dorsal softray ranges 12.2-14.5 per cent SL at smaller sizes decreasing to almost 11.5 per cent SL above 200 mm SL. The first anal softray ranges about 10.8-13.3 per cent SL.

*Pectoral fins.* Each pectoral fin consists of one spine at its dorsal origin and 19-20 softrays. The number of softrays is usually the same on each side of a fish, but bilateral variation does occur (15.2 per cent of 66 specimens). Seven of the ten bilaterally variable specimens had one less ray in the left fin than the right. The following frequencies of softrays were obtained: 19 both (2), 19-20 (4), 20 both (46), 20-21 (6), 21 both (8).

The pectorals are blunter at smaller sizes and the fin length is about 20-22.5 per cent SL at 19-50 mm SL. The fins become longer

TABLE 8  
 Frequency distributions of numbers of total curved and straight  
 lateral line scales and scutes in *Trachurus*

Species	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	Mean
<i>lathamii</i>	1	2	10	11	28	22	11	7	4	1															72.5
<i>mediterraneus</i>								1	-	-	2	1	2	-	2	4	2	4	2	-	3	2	2	1	83.2
<i>picturatus</i>																									98.1
<i>trecae</i>																									74.3
<i>trachurus</i>	2	1	1	2	6	7	2	-	1	2															70.4
<i>capensis</i>						2	1	-	-	2	-	-	2												73.8
<i>margaretae</i>			1	-	-	1	4																		72.2
<i>indicus</i>						1	2	3	1	-	1	-	1												74.6
<i>macullochi</i>					4	5	7	-	1	-	1														72.6
<i>declivis</i>																1	3								81.6
<i>japonicus</i>					1	2	3	4	2	1															71.5
<i>symmetricus</i>																									100.5
<i>murphyi</i>																									97.8

(A: range 93-100)  
 (B: range 93-107)  
 (C: range 94-106)

A: 93(1), 96(1), 97(6), 98(2), 99(2), 100(6).

B: 93(2), 94(1), 97(1), 98(2), 100(1), 101(3), 102(3), 103(3), 104(3), 107(1).

C: 94(2), 96(1), 97(3), 98(5), 101(1), 106(1).

and pointed between about 55 and 95 mm SL, and are falcate (28.5-32.5 per cent SL) above 140 mm SL. In Fig. 4 average values are suggested, which were determined by a visual fit; 20.6 per cent SL at 20-40 mm SL, 23.7 per cent SL at 50-75 mm SL, and 30.2 per cent SL at 115-300 mm SL.

*Pelvic fins.* Each pelvic fin has one spine at its lateral origin and five soft-rays (71 specimens). Pelvic fins averaged a greater length at smaller body sizes (16-18.2 per cent SL to 100 mm SL; 14-16.2 per cent above 170 mm SL).

*Gillrakers.* Gillraker numbers of the upper and lower limbs of the lateral side of the first arch tend toward a positive correlation, with a mode at U14-L36 (Table 11). The individual frequency distributions are shown in Tables 3-4 and the combined counts of both limbs for individual specimens in Table 5.

TABLE 9

Relation of maximum heights of scutes in curved and straight parts of the lateral line in *Trachurus*. Shown as ranges of per cent of standard length for both straight and curved part scutes and as ranges of ratio of straight scute height divided by curved.

Species	Curved	Straight	Ratio
<i>lathamii</i>	4.2-6.2	5.0-6.8	1.08-1.28
<i>mediterraneus</i>	3.3-4.3	4.5-5.3	1.15-1.47
<i>picturatus</i>	3.6-5.1	3.9-5.4	1.03-1.21
<i>trecae</i>	2.1-2.9	3.2-4.0	1.39-1.61
<i>trachurus</i>	6.3-8.2	6.5-7.9	0.96-1.15
<i>capensis</i>	4.8-5.2	5.5-5.9	1.05-1.23
<i>margaretae</i>	4.7-6.0	6.5-7.5	1.09-1.48
<i>indicus</i>	3.6-5.1	4.8-5.4	1.06-1.34
<i>mccullochi</i>	4.8-6.9	5.0-7.3	0.98-1.18
<i>declivis</i>	7.5-8.0	6.8-7.4	0.85-1.00
<i>japonicus</i>	5.5-7.0	6.1-7.4	0.98-1.24
<i>symmetricus</i>	2.3-3.1	3.9-4.4	1.29-1.73
<i>murphyi</i>	4.6-5.6	4.8-5.7	0.98-1.07

A single rudimentary gillraker on the anterior end of either the upper or lower limb of the lateral side of the first arch was found in 25.4 per cent of 126 specimens; 5 had the rudiment on the upper limb and 27 had the rudiment on the lower limb.

Numbers of gillrakers over the hypobranchial portion of the lower limb for 118 specimens ranged 11 (10), 12 (47), 13 (40), 14

TABLE 10

Frequency distributions of numbers of dorsal and anal softrays, correlated for individual specimens of *Trachurus lathami*

Anal softrays	28	29	30	31	32	33	34
30			1	1	2	1	
29			1	7	12	2	1
28			12	19	6	2	
27	1	6	10	13	3		
26	1	2	5	2			
25	2			2			
24			1	1			

(17), 15 (3), 16 (1). The ceratobranchial counts ranged 21 (3), 22 (4), 23 (46), 24 (38), 25 (22), 26 (5). Apparently there is only slight positive correlation between hypobranchial and ceratobranchial numbers of gillrakers. A dual mode for combined counts occurs at H12-C23 and H13-C23.

Gillraker numbers apparently do not change as body length increases between 60-305 mm SL.

*Lateral line.* The point of junction of the curved (anterior) part of the lateral line with the straight (posterior) part is usually below the eighth or ninth dorsal softray, ranging from the sixth to the tenth softray. The junction is often bilaterally asymmetrical, ending from 1-4 softrays farther forward on one side than the other (this variation seems to be random, right or left).

The chord of the curved part of the lateral line (33-38.5 per cent SL) is shorter than the length of the straight part (39-45.5 per cent SL), and the lateral-line ratio ranges about 1.1-1.35. A slight bilateral variation in the lengths of each part is apparently random.

Scales (non-scutellated) in the curved part of the lateral line range 29-39 with the following frequencies: 29 (3), 30 (2), 31 (13), 32 (11), 33 (17), 34 (19), 35 (20), 36 (12), 37 (3), 38 (0), 39 (1); counts from both sides of 50 specimens showed 17 with the same number on each side, 21 with one more scale on one side, 11 with 2 more scales, and 1 with 3 more scales. Bilateral variation was apparently random, right or left. The posterior end of the curved lateral line has zero to nine scutes (pointed) with the following frequencies: 0 (1), 1 (6), 2 (11), 3 (28), 4 (30), 5 (14), 6 (7),



TABLE 11

Frequency distributions of numbers of upper and lower limb gillrakers, correlated for individual specimens of *Trachurus lathami*

Upper limb	Lower limb gillrakers								
	33	34	35	36	37	38	39	40	41
16				1	1	2			
15		6	6	6	2	7	3		
14			9	20	10	7	2	2	
13	1	3	15	9	5	4	1		1
12		2							

7 (0), 8 (1), 9 (1); counts from both sides of 51 specimens showed 20 with the same number on each side, 22 with one more scute on one side, 8 with 2 more scutes, and 1 with 3 more scutes, and the variation was apparently bilaterally random. Frequency distribution of the sum of scales and scutes in the curved lateral line is shown in Table 6. The relation between the numbers of scales and scutes in the curved lateral line for individual fish appears to be inversely correlated; higher scale counts are associated with lower scute counts.

Frequency distribution of the numbers of scutes in the straight lateral line is shown in Table 7. Counts of straight lateral line scutes of 58 specimens showed 18 with the same number on each side, 26 with one more scute on one side, 8 with 2 more, 4 with 3 more, 1 with 4 more, and 1 with 5 more. This bilateral variation is apparently random; 19 specimens have more scutes on the left side and 21 specimens have more scutes on the right side.

The pored scales of the lateral line terminate over the median caudal fin rays. The one to four scales (lacking points and thickness of scutes), which form the end of the lateral line [1 (12), 2 (26), 3 (24), 4 (6)], are frequently lost in preserved specimens and thus were not included in the counts of straight lateral line of the total lateral line.

Frequency distribution of the total number of scales and scutes in both parts of the lateral line (excluding the 1-4 terminal scales) are shown in Table 8. Bilateral variation (apparently random) occurs in this total count; in 57 specimens 11 have the same count on

TABLE 12

Frequency distributions of character index sums for dorsal-anal softrays, upper-lower limb gillrakers, and scales-scutes in the lateral line for *Trachurus lathami*, grouped by geographic area.

	Dorsal-anal softrays											Mean
	53	54	55	56	57	58	59	60	61	62	63	
Atlantic U. S.				4	5	9	5	3	6	2	2	58.9
Gulf U. S.		1	1	3	1	5	10	5	5	-	1	58.8
Mexico				1	1	1	3	2	2	1		59.3
Colombia-Surinam			3	5	5	8	6	3	2			57.8
Brazil-Argentina	2	1	-	-	2	2						55.7
Upper-lower limb gillrakers												
	46	37	48	49	50	51	52	53	54	Mean		
Atlantic U. S.			1	2	7	4	9	3	5	3	1	49.9
Gulf U. S.					4	4	13	6	2	3	2	50.4
Mexico				1	-	3	3	-	-	2	1	50.4
Colombia-Surinam			2	-	4	7	6	8	4	2	1	50.1
Brazil-Argentina							1	2	1	-	3	52.3
Scales-scutes in lateral line												
	68	69	70	71	72	73	74	75	76	77	Mean	
Atlantic U. S.			1	5	4	11	6	3	2			72.0
Gulf U. S.				3	3	6	4	2	1	1		72.3
Mexico				2	1	2	1	1	1			72.1
Colombia-Surinam					2	6	10	5	3	3	1	73.5
Brazil-Argentina		1	-	-	1	3	2					71.6

both sides, 23 have one more scale or scute on one side, 15 have 2 more, 6 have 3 more, and 2 have 4 more.

*Branchiostegal rays.* Three ceratohyal and four epiphyal rays on both sides of 41 specimens.

*Vertebrae.* Ten precaudal and fourteen caudal centra in 21 specimens.

*Body proportions.* Head length about 27.6-32.8 per cent SL, decreasing slightly above 200 mm SL. Snout length about 8.3-11.4 per cent SL. Eye diameter about 7.8-10.0 per cent SL, decreasing to less than 9.2 per cent SL at sizes larger than 200 mm SL. Postorbital head length about 10.0-13.8 per cent SL, decreasing slightly at larger sizes. Upper jaw length about 10.7-12.9 per cent SL. Maximum depth of upper jaw about 2.8-3.8 per cent SL. Body depth (maximum vertical) 24.2-27.5 per cent SL, average of about 25 per cent SL (Fig. 4).



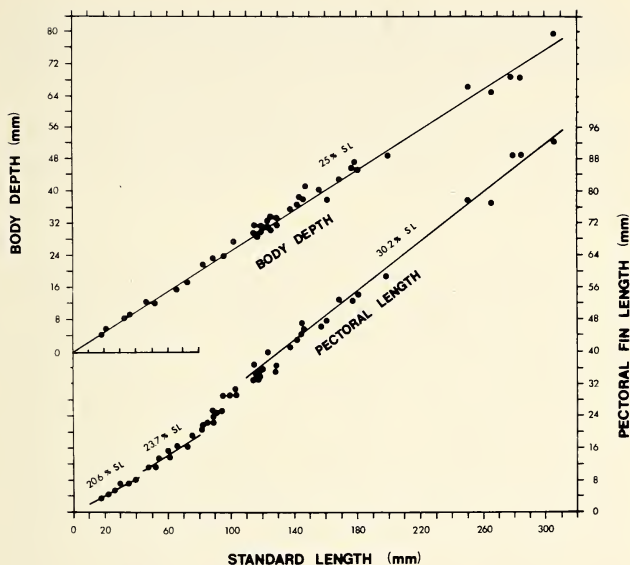


Fig. 4. Relation of body depth (maximum vertical) and pectoral fin length for *Trachurus lathami*. The regression lines and per cent SL values were determined visually.

*Geographic variation.* Several meristic characters suggest shifts of values by area of capture. Three character index values are used in Table 12 to illustrate this suggestion, although the samples available from different areas are insufficient to define or suggest the possible existence of subpopulations. Tabulations of the three characters disclose that specimens from the United States and Mexico are generally similar.

Counts of the sums of dorsal and anal soft-rays disclose that the Colombia-Surinam sample averages more than one ray less than the North American sample; the Brazil-Argentina sample averages two rays less than the former. These counts suggest a decreasing cline from north to south.

Counts of the sums of upper limb and lower limb gillrakers show that the U.S.-Mexico and the Colombia-Trinidad samples are similar, but that the Brazil-Argentina sample has two or more additional gillrakers, which suggests a south temperate shift.

Counts of the sums of scales and scutes in the lateral line reveal that the Colombia-Surinam sample has the highest average value, which suggests a parabolic cline with increasing values in higher latitudes.

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## SPECIMENS EXAMINED

*Trachurus mediterraneus* (26 specimens, 60.5-156 mm SL): Europe, USNM 3563, 1 (116). Italy, AMNH 1508, 1 (95). Sebastopol, USNM 37248, 1 (127). Lebanon, TABL 104857, 6 (135-156); TABL 104707, 11 (60.5-135). Black Sea, UMML 22344, 1 (74); MCZ 41942, 5 (86.5-149).

*Trachurus picturatus* (19 specimens, 95-435 mm SL): Azores, MCZ 16921, 1 (95); MCZ 16922, 1 (98). Madeira, TABL 105887, 5 (150-356); MMF 3858, 1 (240); MMF 3859, 1 (233); MMF 21674, 1 (204); MMF 3432, 1 (158); MMF 4616, 1 (154); MMF 3421, 1 (152); MMF 8860, 1 (144); MMF 3861, 1 (139); MMF 3430, 1 (113). France (Nice, MNHN B.869, 1 (415) holotype of *Caranx suareus*. Tristan de Cunha, BMNH 1935.5.2.3, 1 (412) holotype of *Decapterus longimanus*; BMNH 1927.12.6.76, 1 (412).

*Trachurus trachurus* × *T. picturatus* (3 specimens, 146-200 mm SL): TABL 106537, 1 (146); MMF 5207, 1 (200); MMF 5305, 1 (192).

*Trachurus trecae* (528 specimens, 29-225 mm SL): Mauritania, MNHN 50-71, 2 (158-178) syntypes of *T. trecae*. Guinea, TABL 103676, 10 (147-194); TABL 103681, 11 (121-148); TABL 103664, 2 (104-163); TABL 103672, 13 (114-124); TABL 102873, 1 (157). Ivory Coast, TABL 102762, 1 (103). Ghana, TABL 105446, 3 (110-122); TABL 105440, 4 (111-151); TABL 105441, 1 (99); TABL 105440, 1 (108); TABL 103629, 3 (101-115). Dahomey, UMML 16398, 14 (89-109); UMML 16586, 1 (119); UMML 16783, 4 (83-97). Nigeria, TABL 102764, 3 (129-134); TABL 102768, 1 (110); UMML 21320, 1 (125); UMML 15792, 17 (90-101); UMML 16033, 2 (91-107). Cameroon, TABL 102776, 3 (140-200). Gabon, TABL 102785, 8 (102-182); TABL 102787, 9 (124-144); TABL 105445, 1 (147); TABL 102781, 6 (120-140); TABL 103686, 7 (114-123); TABL 103684, 2 (117-126); TABL 102786, 4 (117-123); TABL 103691, 1 (120); TABL 103687, 5 (110-119); TABL 105442, 6 (128-152). Congo, TABL 103688, 1 (120); TABL 103689, 1 (111); TABL 105443, 11 (29-44); TABL 103666, 3 (103-107). Angola, TABL 102791, 6 (180-225); TABL 102792, 4 (181-210); TABL 102790, 5 (160-190); TABL 103695, 102 (78-117); TABL 103784, 62 (54-153); TABL 103783, 36 (58-197); TABL 103722, 104 (89-184); TABL 103271, 41 (71-172); TABL 105864, 1 (214); TABL 105867, 4 (155-176).

*Trachurus trachurus* (32 specimens, 44.5-273 mm SL): Norway, USNM 23047, 2 (44.5-67); USNM 22067, 2 (45-68); MCZ 2968, 2 (65.5-75.5). Denmark, USNM 39766, 1 (80). Spain (Cadiz), MCZ 22468-9, 2 (153-156). Italy, AMNH 7181, 2 (131-133). Lebanon, TABL 104887, 14 (63-95). Madeira, MMF 157, 1 (174); MMF 2733, 1 (160); MMF 3016, 1 (252); MMF 3207, 1 (273); MMF 3409, 1 (256); MMF 3831, 1 (121); MMF 4052, 1 (149).

*Trachurus capensis* (6 specimens, 175-342 mm SL): Nigeria, TABL 103663, 3 (209-242). South Africa, SAM 11915, 1 (175); SAM 11920, 1 (272); SAM 11947, 1 (342).

*Trachurus margaretae* (6 specimens, 68.5-175 mm SL): South Africa, USNM 153510, 3 (68.5-99); USNM 93661, 1 (123) holotype of *T. margaretae*; SAM 16734, 1 (174); TABL 107267, 1 (175).

*Trachurus indicus* (9 specimens, 89-176 mm SL): Oman, TABL 105384, 3 (168-176); TABL 105998, 1 (174); TABL 106517, 2 (89-103). Persian Gulf, ZMC CN. 3-5, 3 (118-126).

*Trachurus mccullochi* (19 specimens, 78-252 mm SL): Australia, New South Wales, USNM 48810, 2 (111-120); USNM 59919, 10 (99-160); USNM 83046, 1 (124); USNM 148618, 1 (100); USNM 177110, 2 (78-131). New Zealand, USNM 83061, 1 (252); USNM 177075, 2 (166-227).

*Trachurus declivis* (4 specimens, 163-270 mm SL): Australia, BMNH 1917.7.14.30, 1 (163) holotype of *Caranx declivis*; USNM 177009, 1 (164). New Zealand, USNM 177075, 2 (205-270).

*Trachurus japonicus* (13 specimens, 70-295 mm SL): Japan, FMNH 59421, 1 (285) holotype of *T. argenteus*; AMNH 26826, 6 (118-128). China, TABL 107255, 1 (227); TABL 107256, 1 (295); USNM 130405, 1 (215); USNM 130608, 1 (254); MCZ 26324, 2 (70-76.5).

*Trachurus symmetricus* (26 specimens, 104-525 mm SL): Oregon, SU 14375, 1 (380) holotype of *Decapterus polyaspis*; USNM 143676, 1 (392) paratype of *D. polyaspis*. California, TABL 106328, 7 (303-490). Mexico, Baja California, TABL 105868, 1 (148); TABL 105876, 6 (120-179); TABL 105875, 3 (104-107); TABL 105871, 1 (141); TABL 105876, 6 (132-225); TABL 106329, 1 (525).

*Trachurus murphyi* (17 specimens, 94-552 mm SL): Peru, AMNH 7859, 1 (296) putative neotype of *T. murphyi*; AMNH 7260, 1 (295); TABL 105862, 1 (176); TABL 103720, 3 (361-418); TABL 103718, 2 (378-392); TABL 104487, 1 (169); TABL 104481, 1 (200). Chile, TABL 103719, 4 (126-270); TABL 104690, 1 (94); TABL 105587, 2 (548-552).

*Trachurus lathami* (142 specimens, 19-305 mm SL): Massachusetts, MCZ 37141, 1 specimen (91 mm SL). New York, AMNH 7351, 1 (96) holotype of *T. lathami*. North Carolina, TABL 105058, 1 (147); TABL 103653, 1 (115). Georgia, USNM 198978, 2 (132-134), TABL 105053, 2 (96.5-102). Florida Atlantic, TABL 103656, 3 (54.0-71.5); TABL 105056, 4 (120-145); TABL 105066, 1 (35); TABL 105065, 3 (19-33); TABL 105436, 24 (122-146); TABL 103597, 2 (47.8-50.5). Florida Gulf, USNM 198972, 1 (106); USNM 199025, 1 (60); USNM 198985, 2 (146-152); USNM 198981, 7 (62.5-71.5); TABL 106581, 3 (116-123); USNM 198980, 5 (55-73); UF uncat., 1 (150). Alabama, AMNH 15212, 1 (73) holotype of *T. picturatus binghami*. (87 specimens, 57.5-305 mm SL); Mississippi, TABL 105083, 2 (115-125); USNM 198984, 2 (140-141); USNM 198975, 1 (69.5). Louisiana, USNM 199033, 3 (140-143); USNM 198988, 3 (146-158); TABL 105073, 1 (156); TABL 105046, 1 (144); USNM 198989, 1 (182). Texas, USNM 198982, 2 (102-104); TABL 105047, 2 (121-161). Campeche, Mexico, TABL 105048, 1 (138); USNM 198979, 3 (112-140); USNM 199031, 2 (138-139); USNM 199030, 1 (117); USNM 199030, 1 (139). Tabasco, Mexico, USNM 198971, 2 (57.5-81). Colombia, TABL 103205, 4 (117-129); TABL 105077, 1 (153); TABL 101540, 8 (125-183); TABL 101475, 1 (251); TABL 105074, 11 (75.5-103). Venezuela, TABL 105863, 1 (196); TABL 101474, 10 (115-127); TABL 107268, 1 (116); TABL 107269, 2 (106-110). Grenada, TABL 105075, 2 (124). Trinidad, TABL 105072, 4 (169-200); TABL 101836, 2

(146-266); TABL 104854, 1 (305); TABL 105597, 1 (278). Surinam, TABL 105596, 1 (285); UMML 4007, 1 (198). French Guiana, UMML 11586, 1 (181). Brazil, São Paulo, DZSP 5249, 5 (135-146). Argentina, SU 52384, 2 (83-150).

## LITERATURE CITED

- ALEEV, Y. G. 1956. The systematic position of the Black Sea mackerel *Trachurus*. In Russian. *Voprosy Ikhtiologii*, vol. 7, pp. 174-184.
- AYRES, W. O. 1855. Description of new species of California fishes. *Proc. California Acad. Sci.*, vol. 1, p. 62.
- BARNARD, K. H. 1927. A monography of the marine fishes of South Africa. Part II. *Ann. South African Mus.*, vol. 21, no. 2, pp. 419-1065.
- BERRY, F. H. 1968. A new species of carangid fish (*Decapterus tabl*) from the western Atlantic. *Contr. Mar. Sci.*, vol. 13, pp. 145-167.
- . 1969. *Elagatis bipinnulata* (Pisces: Carangidae): Morphology of the fins and other characters. *Copeia*, no. 3, pp. 454-463.
- BLANC, M., AND M. L. BAUCHOT. 1961. Sur quatre genres de Carangidae (Téléostéens Perciformes) de la côte occidentale d'Afrique: *Decapterus*, *Caranx*, *Trachurus*, *Suareus*. Affinités et rapports phylogéniques. *Bull. Mus. Nat. Hist. Nat.*, 2 Ser., vol. 32, no. 6, pp. 484-497.
- BOWDICH, T. E. 1825. Fishes of Madeira (*In*) Excursions in Madeira and Porto Santo . . . G. B. Whittaker, London, pp. 121-125.
- CADENAT, J. 1949. Description de quatre Téléostéens nouveaux de la côte occidentale d'Afrique. *Bull. Mus. Nat. Hist. Nat.*, 2e Ser., vol. 21, no. 6, pp. 663-671.
- CAPELLO, F. B. 1868. Description de trois nouveaux poissons des mers du Portugal. *Journ. Sci. Math. Phys. Nat. Lisboa*, vol. 1, pp. 318-322.
- CASTELNAU, F. L. 1861. Mémoire sur les poissons de l'Afrique australe. Paris, vii + 78 p.
- COCCO, A. 1829. Sopra un nuovo specie di *Trachurus*. *Giorn. Inominato*, Messina, 1 p.
- CUVIER, G., AND A. VALENCIENNES. 1833. Histoire naturelle des poissons. F. G. Levrault, Paris, vol. 9, pp. 1-512.
- FOWLER, H. W. 1938. Descriptions of new fishes obtained by the United States Bureau of Fisheries steamer "Albatross," chiefly in the Phillipine Seas and adjacent waters. *Proc. U.S. Nat. Mus.* (1938), vol. 85, no. 3032, pp. 31-135.
- FURNESTIN, J., J. DARDIGNAC, C. MAURIN, A. VINCENT, R. COUPÉ, AND H. BOUTIÈRE. 1958. Données nouvelles des poissons du Maroc Atlantique. *Rev. et Trav. Inst. Pêches Mar.*, vol. 22, no. 4, pp. 380-493.
- GIGLIOLI, E. H. 1880. Pisces. *In* Elenco dei mammiferi . . . e catalogo degli anfibi e dei pesci italiani. Firenze, pp. 18-55.
- GRONOVIVS, L. T. 1854. Catalogue of fish collected and described by . . . now in the British Museum. Ed. J. E. Gray. London, 196 p.
- JENYNS, L. 1841. Fish. *In* Charles Darwin editor. The zoology of the voyage

- of H. M. S. Beagle. Smith, Elder, and Co., London, pt. IV, XVI + 172 p.
- JORDAN, D. S. 1917. The genera of fishes. Stanford Univ., Univ. Ser. no. 1, pp. 1-161.
- JORDAN, D. S. AND B. W. EVERMANN. 1896. The fishes of North and Middle America. Bull. U.S. Nat. Mus., no. 47, pt. 1, 1240 pp.
- LACÉPÈDE, B. G. E. 1802. Histoire naturelle des poissons. Plassan, Paris, vol. 3, pp. 1-803.
- LINNAEUS, C. 1758. Systema Naturae. L. Salvii, Holmiae, ed. 10, vol. 1, pp. 1-824.
- LOWE, R. T. 1841. Synopsis of the fishes of Madeira. Trans. Zool. Soc. London, vol. 2, pp. 173-200.
- MCCULLOCH, A. R. 1915. Report on some fishes obtained by the F.I.S. "Endeavour." Part III. Commonwealth of Australia, Dept. Trades and Customs, Fisheries.
- MALM, A. W. 1877. Göteborgs och Bohusläns fauna. Rygggradsdjuren. Göteborg, 674 p.
- NANI, A. 1950. Una nueva subespecie de "Surel," *Trachurus picturatus australis* (Pisc. fam. Carangidae). Pri. Cong. Nac. Pesq. Mar. Ind. Deriv., vol. 2, pp. 167-194.
- NECRASSOV, V. V. 1966. A new subspecies of *Trachurus* (*Trachurus mediterraneus indicus* Necrassov subsp. n.) in the Indian Ocean. In Russian. Zool. Zh., vol. 45, pp. 141-144.
- NICHOLS, J. T. 1920. A key to the species of *Trachurus*. Bull. Amer. Mus. Nat. Hist., vol. 42, no. 13, pp. 477-481.
- . 1934. On *Trachurus capensis* Castelnau. Copeia, 1935, no. 2, p. 104.
- . 1940. Notes on carangin fishes. V.—Young *Trachurus* in the Gulf of Mexico. Amer. Mus. Novit., no. 1067, 4 p.
- NILSSON, S. 1832. Prodrömus ichthyologiae scandinavicae. Bertingianis, Lundae, 124 p.
- NORMAN, J. R. 1935. The carangid fishes of the genus *Decapterus* Bleeker. Ann. Mag. Nat. Hist., ser. 10, no. 16, pp. 252-264.
- PALLAS, P. S. 1811-1842. Zoographia Rosso-Asiatica. Petropoli, 3 vols.
- POLL, M. 1954. Poissons. IV. Téléostéens acanthoptérygiens (Première partie). Expéd. Océanogr. Belge Côt. Afr. Atl. Sud (1948-1949), Rés. Sci., vol. 4, no. 3A, pp. 1-390.
- RAFINESQUE, C. S. 1810. Caratteri di alcuni nuovi generi e nuove specie di animali e piante della sicila. Sanfilippo, Palermo, 105 p.
- . 1815. Indice d'ittologia siciliana ossia catalogo metodico dei nomi latini, italiani, e siciliani dei pesci. Presso Giovanni del Nobolo, Messina, 70 p.
- RICHARDSON, J. 1842. Report on the present state of the ichthyology of New Zealand. Rept. Brit. Assoc. Adv. Sci., 12th meet., pp. 12-30.
- SLASTENENKO, E. P. 1965. The species composition of genus *Trachurus* in the Black Sea. Rapp. Réun. Comm. Int. Explor. Scient. Mer. Méditerr., vol. 18, pp. 269-272.



- SMITH, J. L. B. 1961. The sea fishes of South Africa. Cent. News Agency, Ltd., Cape Town, 4th Ed., XVI + 580 p.
- STEINDACHNER, F. 1868. Ichthyologischer Bericht über eine nach Spanien und Portugal unternommene Reise. V. Sitzber. Akad. Wiss. Wien, 1. Abth, pp. 351-424.
- TEMMINCK, C. J., AND H. SCHLEGEL. 1842-50. Pisces. In F. Siebold, editor, Fauna Japonica. A. Arnz et Socios, Lugduni Batavorum, 323 p.
- TORTONESE, E. 1952. Monografia dei carangini viventi nel Mediterraneo. Ann. Mus. Civ. Storia Nat. Genova, vol. 45, pp. 259-324.
- WAKIYA, Y. 1924. The carangoid fishes of Japan. Ann. Carnegie Mus., vol. 15, nos. 2-3, pp. 139-293.
- WALFORD, L. A., AND G. S. MYERS. 1944. A new species of carangid fish from the northeastern Pacific. Copeia, no. 1, pp. 44-47.
- WHITEHEAD, P. J. P., M. BOESEMANN, AND A. C. WHEELER. 1966. The types of Bleeker's Indo-Pacific elopoid and clupeoid fishes. Zool. Verh., vol. 84, pp. 1-159.

#### ADDENDUM

A publication reviewed after our submission of this manuscript recommended a change in synonymy for one of the two Australian species of *Trachurus*. In "A check list of the fishes recorded from the New Zealand region," Australian Zoologist, vol. 15, pt. 1, pp. 1-102, G. P. Whitley listed as synonyms four species described in 1843 by John Richardson, namely: *Scomber clupeioides*, *Scomber dimidatus*, *Trachurus novaezelandias*, and *Caranx sinus-obscuri*. We presume that these four might all be junior synonyms of *Trachurus declivis* (Jenys, 1841).

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